DESAL+
Laboratorio de I+D en Desalación

MAC 2014-2020
Cooperación Territorial

Interreg
Fondo Europeo de Desarrollo Regional

# DESAL+ LIVING LAB

*An accessible place to carry out R&D&i related to desalination*

**This R&D&i platform is promoted by the DESAL+ project, co-financed by FEDER funds through the INTERREG MAC 2014-2020 programme (MAC/1.1a/094)**

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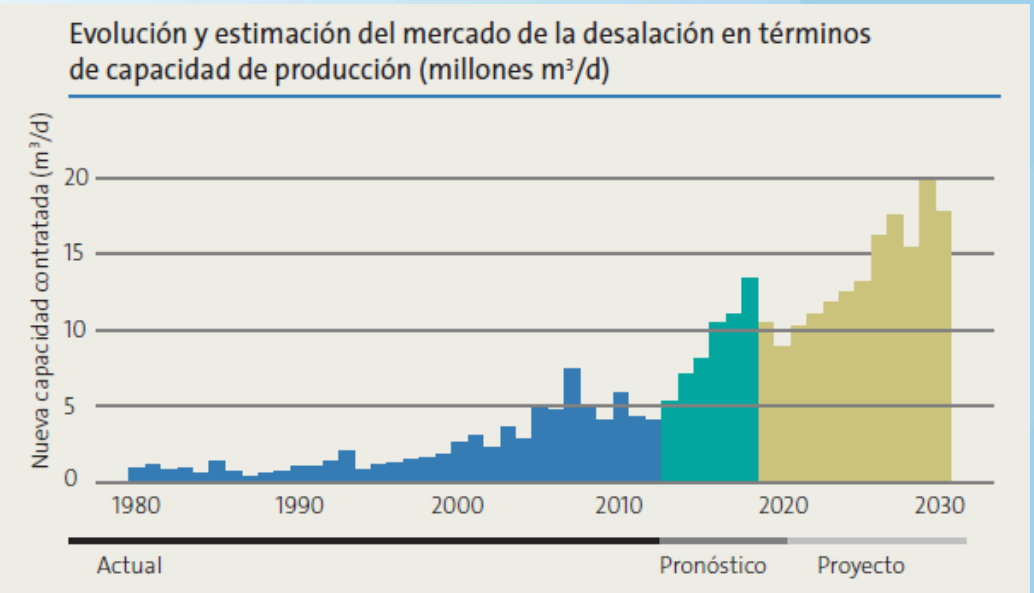
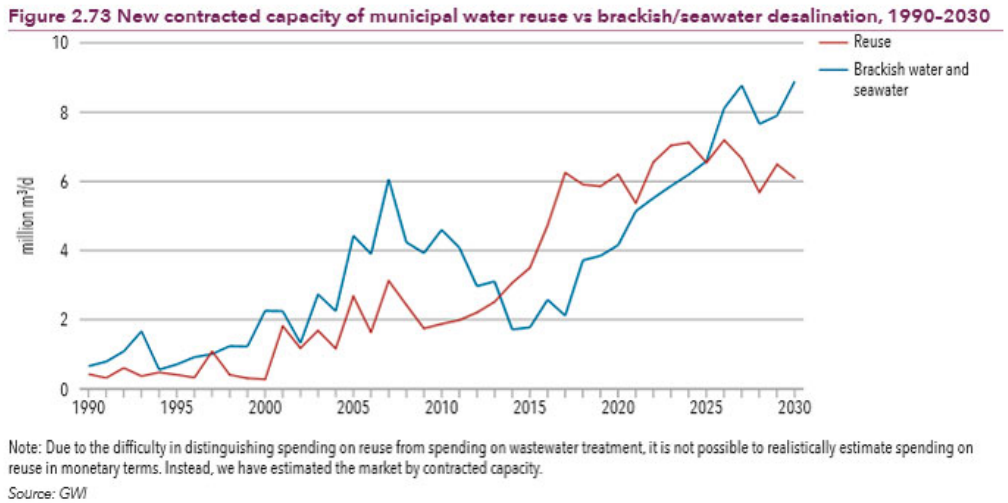
Gobierno de Canarias

# Desalination worldwide




Water desalination (sea water, brackish water, reclaimed water, industrial fluids recovery) is an industrial activity of international expansion.

Presenting business figures with contracts of millions of euros and with an installed capacity that exceeds 90,000 million m³/day of desalinated water throughout the planet.

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# DESAL+ LIVING LAB: where we are

Macaronesia  area is a collection of four archipelagos in the North Atlantic Ocean off the coast of the continents of Europe and Africa.

From north to south, these are:

- Azores (Portugal)
- Madeira (Portugal), also including the Selvagens Islands
- Canary Islands (Spain)
- Cape Verde


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# Desalination in the Macaronesian area

- More than 350 desalination plants in operation
- The highest density of desalination plants per $km^2$ in the world.
- More than 700,000 $m^3$/day of installed capacity (about 1% of the global installed desalination capacity).

  Great dependence on imported fossil fuels.
- More than 50% of inhabitants and 14 millions tourists are being supply with desalted water. Agriculture and recreational areas for irrigation too.

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# R&D&i OPPORTUNITIES IN THE CANARY ISLANDS

- 50 years of experience in the exploitation of desalination plants
- Existence of a great variety of plant sizes, with a wide diversity of technologies, design conditions and locations
- Availability of desalination infrastructures and pilot plants for experimentation
- Excellent availability of natural resources: sun, wind and sea
- Relevant high-qualified researchers, engineers and desalination plant operators

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# CREATION OF THE DESAL+ LIVING LAB

DESAL+ LIVING LAB was born in 2017 with the aim to:

- To place on the map the Canary Islands as a global benchmark in the field of desalination and attracting international R&D&i projects to the Canaries
- Increase the investment in R&D&i in desalination, the knowledge of the water - energy nexus and allocating resources in a coordinated way
- Facilitate practical innovation and accelerate the search for solutions to the technological shortcomings of desalination, by providing researchers, manufacturers and end users with quick and simple access to the means and resources they need
- Develop solutions and demonstrative and innovative projects related to water desalination technologies and the applied use of renewable energies
- Consider Africa and Latin America as key desalination markets

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# DESAL+ LIVING LAB DESCRIPTION


DESAL+ LIVING LAB is an open-access research ecosystem with several experimental and real locations in the Canary Islands mainly. With partners in Cape Verde, Madeira and Mauritania too.

Testing, experimentation and demonstration can be carried out for the purpose of promoting and maturing the commercial potential of a (technology, product and/or service.

The DESAL+ LIVING LAB has created the necessary conditions, infrastructures and protocols for access to desalination plants to enable universities, research and technology centers, manufacturers, companies, operators and end users to collaborate and cooperate, using all the resources available within the ecosystem.

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# DESAL+ LIVING LAB CONSORTIUM

Led by the Instituto Tecnológico de Canarias (Canary Islands Institute of Technology - ITC), this public-private platform consists of a coordinated partnership of research groups, local public institutions and companies, which cooperates in applied research on desalination making their resources and skills in desalination available to the end-users.

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Consejería de Economía, Industria, Comercio y Conocimiento

Agencia Canaria de Investigación, Innovación y Sociedad de la Información

UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA

Universidad de La Laguna

PLOCAN consorcio PLATAFORMA OCEÁNICA DE CANARIAS

MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

Gobierno de Canarias

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# DESAL+ LIVING LAB ASSOCIATES

A series of local institutions and companies from the public-private sector also collaborate, providing experience, knowledge, resources and infrastructure.

CONSEJO INSULAR DE AGUAS DE GRAN CANARIA

Mancomunidad del SurEste GranCanaria

FCCA

Consejo Insular de Aguas de El Hierro

SOSLAIRES CANARIAS, S.L.

emalsa

CANARAGUA

ECOSTEC water technologies

APP ÁGUAS DE PONTA PRETA

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# R&D&i PRIORITY LINES (2018-2025) (1/3)

1. Advanced maintenance (preventive and predictive ) in order to guarantee the efficiency throughout the facility lifetime.

2. Automation, big data treatment and artificial intelligence application in order to introduce improvements in efficiency and cost control.

3. Pre-treatment: Actions to maintain and/or improve the water quality demanded at the entrance to the reverse osmosis membranes.

# R&D&i PRIORITY LINES (2018-2025) (2/3)

4. Membranes 4.0: The testing and operation of these critical elements to maximise the useful lifetime of reverse osmosis membranes.

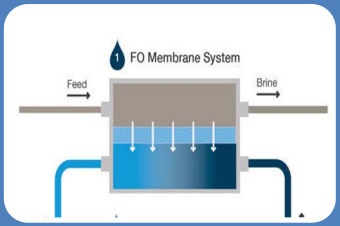
5. Desalinated water-energy nexus: To improve the energy efficiency of the desalination process and the direct use of renewable energy.

6. Desalted water quality: To improve the quality of desalted water for multiple uses, specially, for agricultural irrigation.

# R&D&i PRIORITY LINES (2018-2025) (3/3)

7. Brine and circular economy: Solutions and processes that allow the valorisation of brine and/or the transit to the minimum possible discharge.

8. Green chemistry: New processes, developments or forms of operation to reduce/eliminate the use of chemicals in desalination or to replace them by other more sustainable products.




9. Emergent desalination technologies: New desalination technologies to becoming an alternative or complement to reverse osmosis.

# R&D&i ACTIVITIES

- Modelling and simulation of the desalination process.
- Technologies, processes and efficient designs for seawater and brackish water desalination.
- Integration and optimization of renewable energy (wind, solar, marine) sources for desalination.
- Reverse osmosis: energy saving, energy recovery and direct use of renewable energies to the desalination process.
- Energy and environmental characterization of the desalination processes. Indicators of energy efficiency, eco-efficiency and energy sustainability.
- Large-scale studies (insular, commonwealth) of the contribution of renewable energies to desalination.
- Application of intelligent techniques in the field of the predictive maintenance in desalination.
- Control, evaluation and proposals for improvement the physical-chemical and microbiological quality of desalted waters for different uses.
- Management of brine discharge. Design and selection of technologies for brine recovery.
- Green-chemistry applied to desalination process.
- Scientific-technical and economical advice.

# R&D INFRAESTRUCTURES

A unique in the world desalination-oriented real-life and testbed infrastructure has been defined to research, develop, test and validate water desalination solutions:

- ITC Pozo Izquierdo seawater desalination test-bed facilities (pilot, experimental and pre-industrial conditions) – 0,1 $km^2$ – wind energy and solar photovoltaic fields, seawater intake and brine discharge.
- PLOCAN off-shore platform (pilot, experimental, pre and industrial conditions) – 23 $km^2$ – 600 m maximum depth.
- ITC Water laboratory (sea, brine and desalted water characterization).
- 3 demo areas inside in private industrial desalination plants (real conditions tests).
- 3 pilot desalination plants for testing.


# HUMAN RESOURCES

Highly qualified technicians and researchers with more than 20 years of experience, are involved in this Platform, cooperating to promote and facilitate water desalination innovations and solutions driven by renewable energies and to increase R&D excellence and desalinated water-energy nexus knowledge.

In general, the DESAL+ LIVING LAB includes several professional qualifications:

- 2 University professors
- 17 Ph.D.
- 5 Engineers
- 1 Graduate

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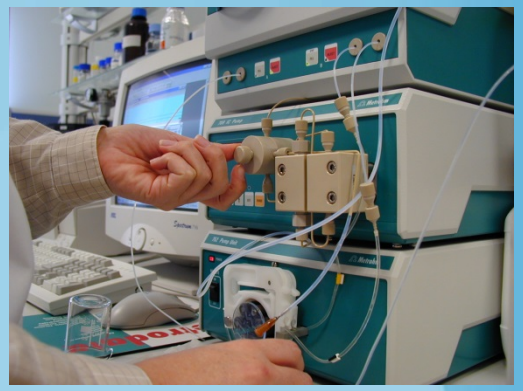
# FIELD AND LAB EQUIPMENTS

Unique high – performance equipment for analysis and tests, field and lab devices, computer equipment and specific software, etc. is available in the Platform. The whole equipment is divided into the following categories:

- Flow and electric meters
- Water Lab and sampling devices (P-C, micro, etc.)
- Off-shore marine meters and vehicles
- Hardware, software and computational devices
- Predictive maintenance devices



These resources are in ourselves use and could be used by externals under different contracted forms:

- Collaborative project
- Shared with supervision
- Leasing
- Service provision

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# INITIATIVES AND PROJECTS

Within the DESAL+ Living Lab, the different actions in which is involved their infrastructure are:

- Studies and technical reports
- Analysis and tests in laboratory
- Testing in pilot plants
- Prototype development
- Applications in real environments
- Software development
- Training

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# SERVICES PORTFOLIO

DESAL + LIVING LAB offers, with its available resources, the following opportunities:

- **Real testbed desalination platform**

Experimental areas, resources and technical and logistic support for the installation and testing of prototypes and new devices focused on desalination, related fields and renewable energy desalination. Our skills, desalination facilities and resources are made available to research centers and companies with the aim of achieving their research and development goals.

- **Desalination consultancy**

Technical support and consultancy for the development of projects of desalination technology, energy efficiency solutions, desalination governance and renewable energy integration to desalination.

- **Desalination knowledge and technology transfer**

Training activities, educational programs, researcher internship, knowledge and technology transfer, technical specifications, technical tender documentation.

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# THANKS FOR YOUR ATTENTION

**More information:**
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